

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

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UNITED STATES PATENT AND TRADEMARK OFFICE

PAT. & T.M. OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SHUNPEI YAMAZAKI
and TAKASHI INUSHIMA

Appeal No. 94-2521
Application 07/793,003¹

HEARD: July 10, 1996

Before LYDDANE, BARRETT, and PAK, Administrative Patent Judges.
BARRETT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the final rejection of claims 1-4, 6-13, 15-18, and 20, all the claims remaining in the application.

¹ Application for patent filed November 15, 1991, entitled "Method of Forming an Oxide Insulating Film."

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The claimed invention is directed to a method of forming an oxide insulating film having improved interface characteristics, that is, having a lower flat-band voltage which implies higher electrical stability. An oxide insulating film is deposited by sputtering under irradiation of light in an atmosphere with a mixture of oxidizing gas and inactive gas, where the volume ratio of the oxidizing gas is greater than that of the inactive gas.

Claim 1 is reproduced below.

1. A method of forming an oxide insulating film comprising:

sputtering a material in an atmosphere comprising an oxidizing gas at a first volume ratio in a chamber;

emitting a light into said chamber to enhance the sputtering; and

depositing the sputtered material on a substrate

wherein said atmosphere further comprises an inactive gas at a second volume ratio wherein said second volume ratio is less than said first volume ratio.

THE REFERENCES

The examiner relies on the following references:

Shirn	3,607,697	September 21, 1971
MacIver et al. (MacIver)	3,624,895	December 7, 1971
Brownell et al. (Brownell)	4,515,668	May 7, 1985
Takasaki et al. (Takasaki)	4,532,022	July 30, 1985
Usami et al. (Usami)	4,597,159	July 1, 1986
Ross	4,849,081	July 18, 1989
European Patent Application 0,190,051 (European '051)		August 6, 1986

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THE REJECTIONS

Claims 1-4 and 6-8 stand rejected under 35 U.S.C. § 103 as being unpatentable over Shirn and either Brownell or Ross. The examiner finds that "Shirn et al. in figure 1 show a reactive sputter deposition of SiO_2 in bell jar 10 which the dictionary indicates that it is made of glass and therefore would pass light into the chamber" (Office action entered April 2, 1992, Paper No. 3, page 3). The examiner states that "[i]t is also considered that while Shirn shows reactive deposition in pure oxygen, however, diluting oxygen with inert gas is well-known in reactive sputtering as evidenced by the secondary references" (Final Rejection entered October 28, 1992, Paper No. 6, pages 2-3).

Claims 9-13, 15-18, and 20 stand rejected under 35 U.S.C. § 103 as being unpatentable over either Takasaki, Usami or MacIver in view of Shirn and European '051. The examiner states (Paper No. 3, page 4):

The primary reference each discloses a method of making capacitor or insulated gate field effect transistor comprising sputter deposition of metal oxide. The difference is that the prior art does not show the light emitting step. The secondary references show that sputter deposition is further enhanced by employing light source. It would therefore be obvious to one of ordinary skill in the art to modify the method of the primary references by adding light source since the gas particles are known to be activated by photo reaction.

OPINION

We reverse.

Claims 1-4 and 6-8

The examiner finds that the bell jar 12 in Shirn inherently meets the limitation of "emitting light into said chamber to enhance the sputtering," as recited in claim 1. Inherency requires that a structure or function be inevitably present. In re Oelrich, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981) ("the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function"). We cannot agree with the examiner's finding of inherency. The cross-hatching for the bell jar in figure 1 of Shirn is a pattern of a solid line and two dashed lines, which is hatching for heat or cold insulation. See Guide for Patent Draftsmen (U.S. Dept. of Comm. Pat. & Trademark Off. 1980), page 16 (copy attached). Because heat or cold insulation is not necessarily transparent, we cannot find that the jar is transparent. As appellant points out (Brief, pages 5-8) there is no suggestion in Shirn that light passes through the wall of the bell jar or that light plays any part in the method of Shirn. The jar may be transparent, but mere possibilities are not enough to establish inherency. In addition, the step of "emitting a light into said chamber" requires a positive step of sending

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out light into the chamber (i.e., it requires more than just the chamber "admitting" light) and it is no more than speculation that light would be emitted from some source into the bell jar even if the jar was transparent to admit the light. It is improper to resort to speculation or unfounded assumptions to supply deficiencies in the factual basis for a rejection. In re Warner, 379 F.2d 1011, 1017, 154 USPQ 173, 178 (CCPA 1967), cert. denied, 389 U.S. 1057 (1968). Because Shirn does not disclose the limitation of "emitting light into said chamber to enhance the sputtering" in claim 1 we reverse the rejection of claims 1-4 and 6-8.

Claims 9-13, 15-18, and 20

Initially, it is not clear what the examiner means by the statements that independent claims 9 and 16 do not require any light sources (Examiner's Answer, page 4, lines 9-11, and page 5, lines 17-18). Claims 9 and 16 are method claims and the "irradiated with a light" limitations are part of the "forming an oxide insulating" film or layer step. No light source structure is required to support the method step. Since the examiner later states that "the scope of 'irradiated with a light' is still considered to be taught by Shirn et al" (Letter entered January 14, 1994, Paper No. 17), we assume that the examiner has considered the limitation in the rejection.

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The examiner apparently relies alternatively on Shirn and European '051 to show the limitation of "at least one of the sputtered material on the way to a surface to be coated therewith and said surface irradiated with a light" in independent claims 9 and 16 (Paper No. 3). As noted, supra, Shirn does not expressly or impliedly disclose the use of light in the sputtering process. Even assuming, arguendo, that Shirn inherently admitted light into the bell jar it would require further speculation to say that the light irradiated the sputtered material or the surface.

European '051 discloses activating a substrate surface with light while sputter coating using a target of SiO_2 to form a silicon oxide film. Thus, the light in European '051 performs the same function of activating the sputtered molecules (page 6, lines 2-11) as appellant's light irradiation step (see specification, page 8, lines 1-9) and meets the limitation of "said surface irradiated with a light." Appellant argues that European '051 "does not, however, disclose that the greater proportion of oxidizing gas than inert gas in the sputtering atmosphere used to form the insulating film to decrease the interfacial state density in a MIS structure, as recited in claims 9 and 16" (Brief, page 10). European '051 discloses that the interior of the casing is evacuated and filled with argon gas (page 5, lines 8-12) and

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does not disclose the limitations of an oxidizing gas at a first volume ratio and an inactive gas at a second volume ratio less than the first volume ratio. Therefore, we look at the teachings of the other references.

The examiner does not address the deficiency of the oxidizing gas and inactive gas limitation in European '051. The Takasaki, Usami, and MacIver references teach methods of making capacitors or insulated gate field effect transistors which include a step for sputter depositing an insulating layer, but do not disclose the oxidizing gas and inactive gas limitation. The reference to Takasaki discloses evacuating the chamber and then "a gaseous mixture consisting of monosilane (SiH_4), ammonia (NH_3) or nitrogen (N_2) and nitrous oxide (N_2O) is introduced into the reactive chamber" (column 3, lines 38-41). Usami discloses sputtering (column 4, lines 23-24), but not the atmosphere except to say that there should not be thermal oxidation (column 4, lines 18-19). MacIver discloses sputtering in an atmosphere of "dry oxygen at a pressure of about 250 microns of mercury" (column 5, line 5). Shirn discloses a mixed oxygen/nitrogen atmosphere; however, the nitrogen is not inactive because it produces Si_3N_4 and, in any case, Shirn does not disclose the use of light so there is no suggestion to provide the mixed atmosphere of Shirn in European '051. Because the examiner has failed to establish a

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prima facie case of obviousness with respect to claims 9 and 16, we reverse the rejection of claims 9-13, 15-18, and 20.


CONCLUSION

The rejections of claims 1-4, 6-13, 15-18, and 20, are reversed.

REVERSED

Will. E. Lyddane
WILLIAM E. LYDDANE
Administrative Patent Judge

Lee E. Barrett
LEE E. BARRETT
Administrative Patent Judge


CHUNG, K. PAK
Administrative Patent Judge

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Guide

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REVISED May, 1980

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Symbols for Draftsmen

37 CFR 1.84(g) states that graphical symbols for conventional elements may be used on the drawing when appropriate, subject to approval by the Office. The symbols and other conventional devices which follow have been and are approved for such use. This collection does not purport to be exhaustive, other standard and commonly used symbols will also be acceptable provided they are clearly understood, are adequately identified in the specification as filed, and do not create confusion with other symbols used in patent drawings.

It should be noted that the American National Standards Institute Inc., 1430 Broadway, New York, N.Y. 10018, publishes a series of publications relating to graphic symbols under its Y32 and Z32 headings, the Office calls attention of patent applicants to these symbols for their consideration and use where appropriate in patent drawings. The listed publications have been reviewed by the Office and the symbols therein are considered to be generally acceptable in patent drawings. Although the Office will not "approve" all of the listed symbols as a group because their use and clarity must be decided on a case-by-case basis, these publications may be used as guides when selecting graphic symbols. Overly specific symbols should be avoided. Symbols with unclear meanings should be labeled for clarification. As noted in 37 CFR 184(g); the Office will retain final authority to approve the use of any particular symbols in any particular case.

The reviewed publications are as follows:

Y32.2—1970. Graphic Symbols for Electrical and Electronics Diagram	\$8.00
32.10—Graphic Symbols for Fluid Power Diagrams	4.00
Y32.11—1961. Graphic Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries	2.25
Y32.14—1962. Graphic Symbols for Logic Diagrams	6.00
Z32.2.3—1949 (R1953). Graphic Symbols for Pipe Fittings, Valves and Piping..	2.25
Z32.2.4—1949 (R1953). Graphic Symbols for Heating, Ventilating and Air Conditioning	2.25
Z32.2.6—1950. Graphic Symbols for Heat-Power Apparatus	2.25

NOTES: In general, in lieu of a symbol, a conventional element, combination or circuit may be shown by an appropriately labeled rectangle, square, or circle; abbreviations should not be used unless their meaning is evident and not confusing with the abbreviations used in the suggested symbols. In the electrical symbols an arrow through an element indicates variability thereof, see for example symbols 2, 6, 12; dotted line connection of arrows indicates ganging thereof, see symbol 6; inherent property (as resistance) may be indicated by showing symbol (for resistor) in dotted lines.

